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The MONITOR

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Deicing Test Sessions
FAA and Pennsylvania 171st Air National Guard

IceCat De-Ices Nose (Off Limits for Glycol)

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The MONITOR is a quarterly publication of the Headquarters Air Force Materiel Command (AFMC) Pollution Prevention Integrated Product Team (P2IPT) dedicated to integrating environment, safety, and health related issues across the entire life cycle of Air Force Weapon Systems. AFMC does not endorse the products featured in this magazine. The views and opinions expressed in this publication are not necessarily those of AFMC. All inquiries or submissions to the MONITOR may be addressed to the Program Manager, Mr. Frank Brown.

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Air Force Materiel Command is Implementing a Compliance Through Pollution Prevention (CTP2) Process to Reduce Environmental Burden and Total Ownership Cost to the Warfighter

In the Pollution Prevention (P2) hierarchy, as shown in Figure 1, source reduction, is the preferred method to achieve cost-effective environmental compliance. P2 addresses pollution at the source. The Air Force Materiel Command's (AFMC's) Compliance through Pollution Prevention (CTP2) Program has been established to ensure future investments in P2 focus on reducing the environmental burden and TOC. Since weapon systems drive most of AFMC's environmental costs, many cost effective P2 solutions will involve changes to fielded weapon system design, operations, or maintenance. AFMC makes it a priority to involve all the appropriate stakeholders, such as the logistics community, in the decision-making and implementation process. The CTP2 program prioritizes those processes for pollution prevention that will reduce the environmental burden and TOC to the warfighter.

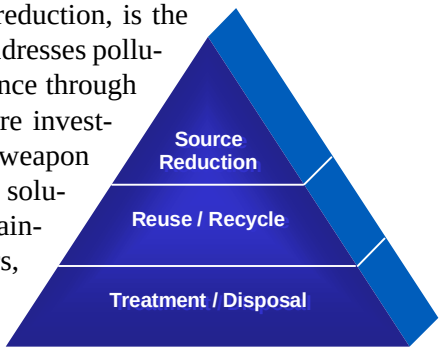


Figure 1. Pollution Prevention Hierarchy

To date, HQ AFMC has completed a Compliance Site Inventory (CSI) for all its installations. Compliance sites are considered "vulnerabilities" and represent an opportunity for inspection by regulatory authorities. HQ AFMC has also established an action plan to implement the CTP2's goals and objectives at the installations. AFMC has published a CTP2 Implementation Guide. It was fielded in July 01 as an interin final (until the AFI is published) and can be accessed at: https://www.afmc-mil-wpafb.af.mil/HQ-AFMC/CE/CEV2/cevq/ctp2htm. To address local concerns, HQ AFMC is providing each installation with a base support personnel to implement the program. This dynamic relationship between HQ planning and base level implementation will ensure that AFMC's CTP2 program takes a consistent approach across the command, while addressing issues specific to each installation.

This article provides an overview of AFMC's CTP2 process, outlines the program's goals and objectives, and summarizes AFMC methodology for conducting process specific opportunity assessment (PSOAs) in support of its overall program.

Overview of AFMC's CTP2 Process

AFMC's CTP2 process transforms the traditional environmental management decision-making process to a business management paradigm. The CTP2 process focuses investment decisions on those processes that reduce the TOC rather than only traditional environmental management costs.

As shown in Figure 2, the CTP2 process with its "plan-do-check-adjust" cycle, is a continuous iterative process and hence establishes a rational methodology to program environmental requirements. Additionally, the prioritization of requirements is established based on cost and risk data and hence clearly focuses on the business aspect of the decision making process.

The first two elements of the CTP2 process, Compliance Site Identification and Burden Determination, build or modify the CSI. Element 3 (Compliance Site Grouping), Element 4 (Group Prioritization), and Element 5 (Process Specific Opportunity Assessments) recommend and select solutions based on reduction of compliance cost

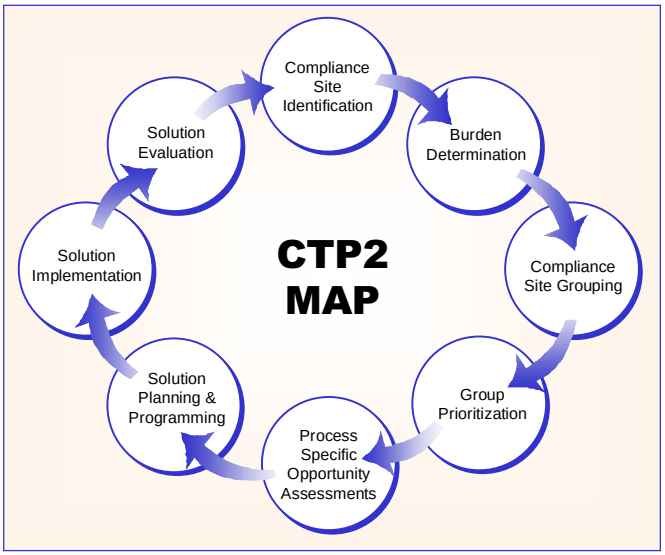


Figure 2. CTP2 Cycle

and risks and on local concerns. Element 6 (Solution Planning & Programming) and Element 7 (Solution Implementation) contain planning and actual implementation steps. Element 8 (Solution Evaluation) provides an evaluation after the solution is fully implemented. The CTP2 MAP is the defining document for that installation's CTP2 strategy. Additional details related to the eight elements of the CTP2 process are provided below.

Compliance Site Identification (Element 1): In 1999, HQ AFMC conducted a CSI for all its bases to jump-start the CTP2 program. A compliance site is any discrete location under Air Force control where any activity occurs that is subject to current or anticipated local, state, or federal environmental regulation. Compliance Sites are considered "vulnerabilities" that represent a potential opportunity for regulatory inspection. AFMC has classified compliance sites into the 10 types listed in Figure 3. The initial evaluation identified over 18,000 compliance sites within AFMC. Edwards AFB leads AFMC installations in potential "vulnerabilities" with 3,057 compliance sites. Rome AFB has the lowest vulnerability with 48 sites.

- Air Sources
- Water Sources
- Hazardous Waste Management Sites
- Resource Conservation and Recovery Act (RCRA) Corrective Action Sites
- Underground Storage Tanks
- Above Ground Storage Tanks
- Pesticide Facilities
- Open Burning/Open Detonation Facilities
- Environmental Protection and Community Right to Know (EPCRA) Storage
- Landfills

Figure 3. Types of Compliance Sites

Burden Identification (Element 2): In 1999, HQ AFMC also collected and assigned cost and risk data to each site using cost distribution spreadsheets and a customized risk algorithm. The environmental cost for each site was determined by applying the recurring cost for each installation's environmental compliance activities (e.g., permitting, sampling and monitoring, record keeping) to the appropriate types and categories of sites. Other costs (e.g., health, civil engineering etc.) were applied to individual or groups of sites, as appropriate.

The risk assessment method, which has Operational Risk Management (ORM) origins, uses methods similar to those used by the United States Environmental Protection Agency (USEPA). The method uses an algorithm with ten (10) factors to assign each site with a comparative risk number, as follows:

$$C_{W\Sigma} \times F_{WF} \times H_{WF} \times M_{WF} \times P_{WF} \times R_{WF} \times E_{WM} \times (O_{AM} + N_{AM} + L_{AM})$$

$C_{W\Sigma}$ = Compliance Weighing Factor
F^{WF} = Future Regulatory Impact
H^{WF} = Hazard Weighing Factor
M^{WF} = Mobility Weighing Factor
P^{WF} = Proximity Weighing Factor
R^{WF} = Release Weighing Factor
E^{WF} = Worker Exposure Weighing Matrix
O^{WM} = Operational Complexity Additive Matrix
N^{AM} = Containers Additive Matrix
L^{AM}_{AM} = Containment Additive Matrix

The resulting unitless risk number is used to compare the site against other sites at that installation.

Compliance Site Groupings (Element 3): The installations are currently grouping the sites by process, activity etc. before prioritizing them using criteria such as compliance burden, mission criticality, visibility, and other local considerations. Currently at AFMC, compliance sites are being grouped together to form Process Specific Groups (PSGs) that will be prioritized and will become candidates for PSOAs. The resulting inventories, maintained by the respective installations, will be web-based and link to the installation's CTP2 MAP.

Group Prioritization (Element 4): Once all the PSGs have been formed, they are prioritized, by first rank ordering on the basis of burden and then adjusting that order for local considerations. AFMC base personnel, in concert with HQ AFMC facilitator, will be completing this activity in FY02.

Process Specific Opportunity Assessments (Element 5): AFMC has developed a PSOA implementation guide that has been distributed to the bases. This document was developed once the HQ AFMC defined the methodology and was field tested at both Robins AFB and Edwards AFB. The PSOAs are the heart of the CTP2 process and are further discussed below.

CTP2 Solution Planning & Programming (Element 6): Based on the results of the conducted PSOAs, Solution Planning & Programming will vary based on the solution category. Some solutions, such as Best Management Practices (BMP) will require little or no funding and can be implemented immediately. Other solutions, such as process changes will require some planning and programming to obtain the necessary funds, while demonstration/validation and research & development solutions will be beyond the installation's funding and require additional coordination. Although AFMC bases have been planning and programming P2 solutions identified in Opportunity Assessments for several years, their efforts under the CTP2 process, which will begin in FY02, will result in improved justification for future projects**.**

Solution Implementation (Element 7): Process owner buy-in is initially established during the PSOA. During the solution implementation, it is critical to verify that the process owner is supportive of the proposed solution. This stage also involves preparation of a cost breakdown and schedule for implementing the solution.

Solution Evaluation (Element 8): This element completes the "plan-do-check-adjust" cycle. CTP2 solutions, once fully implemented, are communicated throughout AFMC so other installations can benefit from the results.

HQ AFMC is currently developing a prototype CTP2 MAP for its installations and will establish an initial headquarters managed effort to complete the first iteration of these MAPs. The AFMC goals and objectives, as stated below, are a critical step in the process of completing the CTP2 MAPs.

Overview of the CTP2 Process's Goals and Objectives

In 2000, HQ AFMC distributed the command's roadmap to achieve CTP2.

First, AFMC established a CTP2 mission statement that requires installations to:

> "sustain and enhance mission readiness by implementing sound cost-effective strategies for complying with existing or new environmental requirements while minimizing or eliminating potential hazards to human health and the environment."

Second, HQ AFMC clearly defines the objectives of the AFMC CTP2 Program, which include the following:

- Objective 1 - Document the correlation between the installation's environmental burden and the base activities using the Compliance Site Inventory (CSI).
- Objective 2 - Develop an initial multi-year investment strategy to target efforts to reduce the installation's environmental burden and improve operations.
- Objective 3 - Implement a process to define opportunities and implement cost-effective alternatives to reduce compliance burden and improve operations.
- Objective 4 - Implement a process to adjust the investment strategy based on completed environmental burden reduction efforts and changing requirements.

Finally, HQ AFMC has actions for Environmental Offices to implement each of these objectives. This information has been summarized in Figure 4 on the next page. The steps defined by these actions lead to completion of the CTP2 cycle discussed above and the completion of the CTP2 MAP.

Objective 1

- Review past P2 Management Action Plans and Opportunity Assessments to define potential compliance site groupings.
- Review past pollution prevention efforts, including demonstration/validation projects, to define compliance site groupings.
- Review the results of the Requirements Development Team (RDT) to define potential compliance site groupings.
- Define groupings for the remaining compliance sites (where appropriate).
- Update descriptive information for compliance sites in the CSI based on the groupings (when necessary).
- Identify in the CSI which sites are associated with each grouping.
- Update cost data in the CSI for each site using previous year environmental quality program expenditures.
- Calculate the burden associated with each grouping.
- Document local concerns that will impact the prioritization process.

Objective 2

- Prioritize groupings and un-grouped sites based strictly on burden.
- Adjust prioritization based on local concerns; such as Environmental Compliance Assessment and Management Program (ECAMP) findings, Notice of Violations (NOV), and points of emphasis from the local regulatory community.
- Review previous project submittals for P2 and Compliance funding to determine those that need to be integrated into the CTP2 funding strategy.
- Identify funding requirements that resulted from previous year projects but have yet to be formally submitted for funding. Include requirements for funding from sources other than the environmental program
- Identify requirements for future Process Specific Opportunity Assessments based on the prioritization of sites/groups.
- Using the prioritized list of compliance sites/groups, identify funding strategy to identify alternatives and reduce burden and TOC. Strategy needs to limit PSOA efforts to addressing 2-4% of compliance sites per year. Strategy should include efforts to acquire funding from sources other than the environmental program.
- Develop introductory information (such as missions of installation organizations and environmental regulatory requirements) for inclusion in the initial CTP2 Management Action Plan (MAP) using information in existing documentation, such as ECAMP reports.
- Develop the initial CTP2 MAP using all previously defined deliverables.

Objective 3

- For those high priority activities that are designated for assessment in any given year, review existing data from previous on-base activities and from external organizations to determine if proven P2 alternatives exist. The HQ CTP2 facilitator will assist in the review of external organizations.
- For those same activities, provide information on existing P2 alternatives to the process owner or, if no alternatives exist, discuss the potential benefits that could result from doing a PSOA on that activity.
- Facilitate the efforts of the PSOA team in assessing a process or activity. Facilitation may consist of identifying the compliance burden, diagramming the process, collecting information on the input and output to and from the various steps of the process, identifying potential alternatives that are being evaluated but have not been proven, or recording minutes of meetings.
- Based on the funding requirements resulting from the PSOA, develop all needed information for requesting P2 project funding. Information will support the development of EQ database narratives, Automated Civil Engineer System (ACES) project narratives and Program Management Review (PMR) charts and should include present regulatory requirements, present environmental and operational costs, and potential environmental and operational benefits. Submittals will identify all phases of the effort needed to implement an alternative.
- Document the requirement for research and development of new technologies. Documentation shall meet the requirements for submittal to the ESOH TPIPT database.

Objective 4

- Evaluate the need the re-accomplish actions Objective 1 bullets 1 through 8 and Objective 2 bullets 1 and 2 based on recent events; such as completion of PSOAs, elimination and addition of sites, completion of a fiscal year, reductions in compliance burden associated with implementation of P2 alternatives, or development of more accurate information on specific sites as a result of completing a PSOA.
- Based on the results of the preceding action, re-accomplish only those aforementioned actions that will impact the out-year P2 funding strategy.
- Document actual benefits resulting from P2 alternatives that were implemented in the previous fiscal year. Documentation will include but not be limited to Program Management Review charts, Success Stories for the semi-annual Deputy Under Secretary of Defense for Environmental Security (DUSD-ES) report, and metric reporting.
- Determine any changes in the mission of the installation or the regulatory drivers impacting compliance burden compared to the initial analysis performed in action seven for Objective 2.
- Update the CTP2 MAP based on the results of the 4 prior actions. “Pen and ink” corrections shall be completed annually. Periodically (but not annually), a contractor may be used to review the CTP2 MAP and make major rewrites.

Figure 4. CTP2 Action Plan by Objective

Overview of the Process Specific Opportunity Assessment Methodology

At the heart of the CTP2 cycle is the process specific opportunity assessment. HQ AFMC has recently completed and distributed guidance to AFMC installations on how to conduct these assessments. HQ AFMC prototyped the model based on field visits and the testing of the methodology both at Robins AFB and Edwards AFB. The methodology has been developed from standard techniques proven to be effective within industry and government. This new approach is similar to new EPA guidance that limits opportunity assessments to selected industrial processes and relies on shop level expertise to identify the true opportunities for process improvement. This section provides an overview of the PSOA methodology.

A full PSOA consists of seven sequential steps, as outlined in Figure 5. Details related to each step are provided below.

Steps in Conducting a Full PSOA

- Develop background information. Find out as much as possible about the selected process and related processes and historic P2 activities.
- Form the PSOA team, a team of individuals that know and understand how the process runs and other experts such as individuals from the installation's EM, Bioenvironmental Engineering, and unit environmental functions.
- Characterize the process using process diagrams.
- Select a process step, or steps, that have a significant opportunity for improvement.
- Conduct a root cause analysis to determine the underlying cause of the opportunity.
- Develop a list of potential solutions.
- Draft an Action Plan for each potential solution.

Figure 5. Seven Sequential Steps of a Full PSOA

Step 1: PSOA Background Development

The first step in AFMC's PSOA methodology is to identify ongoing, planned, or completed studies that have been undertaken for the selected processes. At every installation, there are many organizations that have conducted past work on a given process. For example, if aircraft depainting is considered for a PSOA, the first organization to approach is Logistics. It is also critical to contact other organizations that may have undertaken various studies without directly conducting a PSOA. These types of efforts include process evaluations conducted by installations Technology and Industrial Support (TI) functions, the Air Force Center for Environmental Excellence (AFCEE), Special Program Offices, Integrated Product Teams, System Managers, and Weapon System transition teams.

Step 2: Forming a PSOA Team

The second step in AFMC's PSOA methodology is to form a PSOA team. Non environmental management/civil engineering stakeholders are brought into the process at this time. Process owner support and participation is essential. In some cases "experts" from other functional areas can also serve on the team. It is important that process owners are informed and support the PSOA effort, or implementation of the final solution will be difficult. This approach differs from the traditional approach historically taken in conducing opportunity assessments and should be a great benefit to other functionals, particularly the logistics community.

Step 3: Characterizing the Process

The third step in AFMC's PSOA methodology, characterizing the process, requires developing a detailed diagram of the process. Sometimes one member of the team is given this assignment. S/he works with the individual most familiar with the process (e.g., floor supervisor, senior operator, process engineer) to develop a process-flow diagram. The process-flow diagrams, which are block flow depictions, are developed using the conventional left-to-right "input-process-output" model techniques. In addition to the process flow, the PSOA team should identify all the resources, inputs and outputs associated with the lowest level sub-steps of the process. This information will help the team identify potential opportunities in the process, their causes, and facilitate selecting alternatives.

As a part of this step, two members of the team should be assigned to collecting data on labor, materials, utilities, personal protective equipment, hazardous waste, solid waste, air emission and other associated costs.

Step 4: Selecting Opportunities

The fourth step in AFMC's PSOA methodology is the selection of opportunities. Using the information collected in worksheets developed under Step 3, the team selects one or more of the lowest level steps in the diagram for further study. The intent is to focus on a portion of the process where a change would have the greatest impact. The selection is documented using a separate worksheet for each opportunity selected.

Step 5: Conducting Root Cause Analysis of Selected Opportunities

The fifth step in AFMC's PSOA methodology is conducting a root cause analysis of selected opportunities. The PSOA team then uses root cause analysis to examine the prioritized opportunities. A cause and effect (fishbone) diagram may be used in the process. The team identifies the specific problems/issues for each opportunity to be addressed. It is extremely important that the team explores all possible causes. All PSOA members participate in this step.

Step 6: Developing Potential Solutions

The sixth step in AFMC's PSOA methodology is to develop potential solutions. The root cause analysis provides the ideal lead-in to developing solutions. After thoroughly analyzing opportunities, identifying problems, issues, effects and causes, the team moves on to generate solutions The team conducts the solutions identification phase near, or in, the process location to encourage the participation of those personnel most familiar with the process. The most familiar way of generating solutions is through brainstorming, where participants call out solutions that are written down by a group recorder. The basic objective of the method selected is to facilitate total team participation and creative thinking. Concepts that should be considered include the following:

- Material and chemical substitution
- Changes in material specification
- Eliminating a process entirely
- Significantly changing the process
- Outsourcing the process
- Health protection and safety procedures
- Purchasing procedures
- Personnel requirements
- Equipment changes
- Facility modifications
- Process utility usage changes

The solutions gathered should be grouped into the categories listed in Figure 6 on the next page.

After all solutions are grouped into the five categories, the team does a preliminary ranking of the solutions within their respective categories based on the solution's impact on the process and environmental compliance burden and the ease of implementing the solutions.

Step 7: Drafting Action Plan for the Solutions

The final step in AFMC's PSOA methodology is drafting an action plan for the solutions. The worksheets prepared during the PSOA process are then assembled into a package. It is important that all data sources and/or assumptions are documented. The team also prepares a short (2 page) executive summary for the PSOA. Some processes are complicated enough or the solutions require sophisticated technology evaluations that contract support or other outside resources may be needed.

- **Best Management Practices (BMPs):** These solutions are administrative in nature, involving changes in procedures under process owner control. There is generally no need to take these beyond the process supervisor for approval. They will usually be short term and easy to implement. Typically these solutions involve little or no cost. These solutions also normally have minimal impact on EC cost/risk (burden).
- **Process Change (PC):** These solutions can be as simple as changing a valve or pump, changing or eliminating a fluid or adding a piece of equipment such as a filter. The capital expenditure for this type of solution is generally low in comparison with the capital cost of the process itself. There are four general types of process changes depending upon the decision-making level required for implementation. The appropriate type should be noted along with the process change.
- **Commercial or Government Off-The-Shelf Technologies (COTS/GOTS):** These solutions are generally available as vendor packages and good cost information about them should be readily available. The probability of success should also be well known from their use at other installations or prior demonstrations unless the technology is "brand new". If the past success of the solution is not well known, it should probably be put into the Demonstration/Validation category.
- **Demonstration/Validation (DEM VAL):** These solutions are usually not available off-the-shelf and are in some sort of developmental stage. Typically, some sort of laboratory and/or pilot scale simulation or test run must be performed to demonstrate the viability and economics of the solution. The potential savings from these solutions can be estimated, but normally sufficient information is not available to determine return on investment.
- **Research and Development (R&D):** These are solutions that impact the installation mission or Air Force or have DoD-wide applicability, probably require considerable R&D beyond environmental considerations and likely require approval at the highest level even to pursue. These type solutions should be reviewed for a possible base request for Strategic Environmental Research and Development Program (SERDP) or Environmental Security Technology Certification Program (ESTCP) funding or forwarded to AFMC for command-wide action. Generally, a review/analysis will be performed at headquarters to identify common issues/solutions for any future evaluation. As with the DEM VAL category, potential savings can be estimated but normally sufficient information is not available to determine any return on investment.

Figure 6. Groupings of Potential Solutions Developed Through the PSOA

Conclusion

AFMC's CTP2 Program's primary focus is to target those processes for P2 that will reduce TOC to the warfighter. For the last two years HQ AFMC planning in concert with base level implementation has been developing policies and procedures for the effective implementation of this process across the command. This dynamic relationship between HQ planning and base level implementation will ensure that AFMC's CTP2 process takes a consistent approach across the command, while addressing issues specific to each installation.

For further information about AFMC's CTP2 program, please contact Milt Rindahl at DSN 787-7414 or commercial 937-257-7414.

AFMC Requirements Development Team (RDT)

The focus of the AFMC Requirements Development Team (RDT) was to identify and collect any AF weapon system and supporting process requirements that drive an environmental burden. A cross-functional team visited AFMC installations in FY00 to identify and document ESOH needs at the process level. The identified requirements are linked to specific process, weapon systems, and compliance sites. The requirements are being validated and synthesized into common P2 needs and submitted for inclusion into the Environmental Development Planning, formally the ESOH TPIPT, database. It is anticipated that output of the RDT effort will accomplish the following:

- Assist in building out-year POMs.
- Provide AFRL and SERDP focus for research and development.
- Assist identifying AF weapon system processes for ESTCP P2 funding.
- Assist in fostering joint programs.
- Develop a more robust P2 program.

For additional information regarding the AFMC RDT Program, please contact Warren Assink at DSN 674-0151 or via e-mail at Warren.Assink@wpafb.af.mil.

Overview of Air Force Materiel Command's (AFMC's) Weapon System Hazardous Materials Program

According to the revised AFI 32-7086, the weapon system hazardous materials program describes how to integrate identified weapon system HAZMAT reduction needs into both existing weapon system management processes and into the development of new weapon systems.

Since over 80% of the opportunities for weapon system pollution prevention are AFMC functions, the command's program supports the whole of the Air Force. AFMC's weapon system hazardous materials program focuses on projects that affect multiple weapon systems. AFMC Pollution Prevention Integrated Product Team's (P2-IPT's) weapon system hazardous materials program strategy is to leverage resources to provide cost effective solutions to multiple weapon systems pollution prevention needs to reduce the overall AF compliance burden. Other MAJCOMs that may want to participate in the AFMC program can submit their pollution prevention technology needs through the Environmental Development Planning formally ESOH TPIPT.

At AFMC, the working level Weapon System Hazardous Materials Program is implemented through the AFMC Center Working Group (CWG) with overall guidance from the AFMC P2-IPT. In 2001, the AFMC P2-IPT integrated weapon system issues in the Compliance through Pollution Prevention (CTP2) process, thereby addressing weapon system hazardous material priorities. Additionally, the HQ AFMC P2-IPT is assisting in bridging relationships between Environmental Management and other functional areas (e.g., LG, EN, SG) at base level. It is anticipated that Environmental Managers at the base level, in conjunction with other functional members, will prioritize compliance site groupings. For weapon system hazardous materials, the CWG members at the base level will lead this effort.

The HQ AFMC P2-IPT is also managing efforts to demonstrate/validate and integrate emerging technologies within AFMC. Although managed through AFMC, this program implements P2 efforts that benefit the entire Air Force. The AFMC P2-IPT worked this past year to formalize a strategy to leverage resources to conduct multiple weapon system projects.

For further information on AFMC's weapon system pollution prevention program, please contact Mr. Ed Finke at DSN 787-6312, or via e-mail at Edward.Finke@wpafb.af.mil.

Requirements Collection & Funding Process

Air Force Materiel Command (AFMC) is responsible for the integrated management of research, development, acquisition, and support of AF Weapon Systems. As such, the command is responsible for 80% of the functions that represent potential opportunities for weapon system pollution prevention. AFMC takes a teaming approach in integrating weapon system HAZMAT reduction needs into the weapon system requirements generation, prioritization, funding, and execution process. AFMC determines needs, develops a POM based on the needs, budgets for execution year, validates projects through the HQ AFMC Pollution Prevention Integrated Product Team (P2-IPT), and where possible, leverages resources to accomplish its goal. On the weapon system pollution prevention continuum, HQ AFMC P2-IPT funds projects that fall in the technology integration, demonstration/validation to fielding category.

AFMC Product, Test, and Air Logistic Centers use the Environmental Development Planning formally ESOH TPIPT to submit needs. These needs are prioritized and projects that have multiple weapon systems impact are identified. The central repository for requirements collection within AFMC and the Air Force is the Environmental Development Planning. This process facilitates requirements generation, prioritization, and then the subsequent funding and execution for HAZMAT reduction. This process has been augmented at AFMC by the Requirements Development Team, which has identified and documented P2 Needs at the process level.

Finally, through its Pollution Prevention Project Narrative (PPPN) submittal process, AFMC funds high priority projects that impact multiple weapon systems. The HQ AFMC P2-IPT reviews AFMC cross-functional PPPNs for validity, feasibility, duplication of effort, and to ensure the correct organizations are finding the solutions. Where feasible, funds from other sources, such as the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP), are leveraged to support these projects.

For more information regarding AFMC's requirements collection and funding process, please contact Mr. Ed Finke at DSN 787-6312 or via e-mail at Edward.Finke@wpafb.af.mil.

AFMC Funding Process – Pollution Prevention Project Narrative (PPPN) Process

The Pollution Prevention Project Narrative (PPPN) process was developed by HQ AFMC to have a standardized methodology for submitting and validating projects across the command. For weapon system pollution prevention projects, the HQ AFMC P2-IPT reviews AFMC submitted narratives for validity, feasibility, duplication of effort, and ensures the correct organizations are finding the solutions. Details related to this process are provided below.

HQ AFMC asks the product centers, installations, AFRL, HQ AFMC/LGP-EV, and other customers to submit PPPNs to the command by November of each year. HQ AFMC Pollution Prevention Team reviews the submitted PPPNs and provides comments back the submitter by December to improve the quality of the narratives and to provide additional details, as necessary. From January – March, the submitter revises the narratives and submits them back to HQ AFMC/CEVV for the HQ AFMC P2-IPT's initial review. In April of each year, all PPPN submitters attend a Program Management Review (PMR) at AFMC, where they defend their projects. Based on the question posed by the HQ AFMC P2-IPT, the submitter provides final revisions to the PPPNs by June of each year. By July of each year, the Validation Review Board makes its final determination of which PPPNs represent valid projects for the coming fiscal year.

For more information regarding AFMC's weapon system PPPN process, please contact Mr. Ed Finke at DSN 787-6312 or via e-mail at Edward.Finke@wpafb.af.mil.

Air Force Materiel Command Evaluates Impact of Environmental, Safety, and Occupational Health (ESOH) Regulations on Air Force Weapon Systems

Environment, Safety, and Occupational Health (ESOH) concerns represent a significant challenge to weapon system maintenance and usage. Within the Depot Maintenance Activity Group (DMAG) painting/depainting, cleaning, and plating are major ESOH cost drivers. ESOH concerns impact heavily on the logistics footprint and changing regulations can significantly impact weapon system life cycle costs. For example, between FY1992 and FY2000, ESOH operational expenses have nearly tripled.

The future challenge to Air Force Materiel Command (AFMC), who owns approximately 80% of the AF's environmentally regulated processes and generates between 40 and 45% of the annual USAF hazardous waste volume, is to cost effectively comply with existing and future regulations. AFMC/LG is faced with complying with increasingly stringent regulatory requirements, identifying and targeting current and future DMAG cost drivers, and updating practices to lessen impacts to facilities, logistical footprint, and the warfighter.

Currently, numerous ESOH regulations are being developed and imposed on Department of Defense (DoD) operations at both the depot and operational units. In FY2001, two new or revised Clean Air Maximum Attainable Commercial Technology (MACT) standards were released for comment or actively discussed between the Environmental Protection Agency (EPA) that impact Air Logistics Centers (ALC) operations. In addition, two other new proposed MACT rules directly affect our component suppliers, which also indirectly impact AFMC.

AFMC/LGP-EV is working with HQ AFMC/CEVQ, Air Logistics Centers (ALCs) and System Program Offices (SPOs) to help determine their potential impacts on the weapon systems. The goal of this initiative is to monitor, evaluate, and determine impacts of ESOH regulations on AFMC depot operations. Where economically feasible, AFMC may modernize processes currently used in depots and thereby reduce both the logistical footprint and impact to the weapon system from these future ESOH driven costs.

For further information regarding this initiative, please contact Mr. Warren Assink, AFMC/LGP-EV at DSN 674-0151.

Regulatory Update

On 2 August 2001 in the Federal Register, the Environmental Protection Agency (EPA) proposed an amendment to Title 40, chapter I, part 63 of the Code of Federal Regulations. This action proposes national emission standards for hazardous air pollutants (NESHAP) for new and existing reinforced plastic composites production facilities. The proposed standards regulate production and ancillary processes used to manufacture products with thermoset resins and gel coats. Reinforced plastic composites production facilities emit hazardous air pollutants (HAPs), such as styrene, methyl methacrylate (MMA), and methylene chloride. Exposure to these compounds has been demonstrated to cause chronic and acute health disorders. Additionally, some compounds have been classified as possible or probable human carcinogens. The proposed standards will implement section 112(d) of the Clean Air Act (CAA) by requiring all major sources in this category to meet HAP emission standards reflecting the application of the maximum achievable control technology (MACT).

The primary source of HAP emissions from the Reinforced Plastic Composites Production source category is the evaporation of styrene and other organic liquid HAP contained in the resin during the application and/or curing of the resin. The HAP emissions also occur during related operations such as cleaning, mixing/BMC manufacturing, and storage. EPA estimates that the proposed NESHAP would reduce nationwide emissions of HAP from these facilities by approximately 14,500 tons per year (tpy), which is a reduction of 65%.

Processes and Operations Included

The Reinforced Plastic Composites Production source category involves the production of plastic products from cross-linking resins, usually in combination with reinforcing materials and inorganic fillers. This source category is limited to those resins that contain styrene, either by itself or with a combination of other monomers or solvents. The manufacturing of products that do not contain reinforcing materials is also included in this category, as well as the production of intermediate compounds that are later used to make the final plastic products. These non-reinforced products were included because they are produced using the same types of resins, have similar emission characteristics, and would use similar emission controls.

There are a wide variety of operations that use styrene-containing resins to make thermoset plastics. There are also ancillary operations such as cleaning, mixing/bulk molding compound (BMC) manufacturing, and storage that occur in conjunction with these production operations. Many facilities use multiple operations in the manufacturing of their product. Under the proposed rule, the affected source is defined as the combination of all reinforced plastic composites operations at a production facility. As such, the following operations may be regulated as part of the affected source: open molding, closed molding, centrifugal casting, continuous lamination/continuous casting, polymer casting, pultrusion, SMC manufacturing, equipment cleaning, BMC/manufacturing/mixing, and storage of HAP-containing materials. This category does not include facilities that repair previously manufactured reinforced plastic composites, and do not have any co-located reinforced plastic composite manufacturing operations.

This broad source definition of the affected source allows a manufacturer to determine compliance by averaging the HAP content of different products used throughout the facility and to use different application techniques as needed to meet product quality specifications.

Compliance Issues

EPA has proposed the NESHAP requirements in the form of emission limits (i.e., point value, mass rate, or percentage reduction), operating limits, and work practice standards. Proposed threshold limits for existing sources have been established. For small businesses, the threshold is 250 tpy of combined HAP emissions for open molding, centrifugal casting, continuous lamination/casting, pultrusion, and SMC manufacturing. The threshold for large businesses is combined HAP emissions of 100 tpy from the same operations. In addition, the following general guidelines are proposed:

- For continuous lamination/continuous casting operations at existing sources below the threshold, and new sources with HAP emissions less than 100 tpy, to reduce emissions by 58 percent.
- For pultrusion operations at existing sources below the threshold, and new sources with HAP emissions less than 100 tpy, to reduce emissions by 60 percent. The reduction is based on applying a wet enclosure or using direct die injection to limit emissions.

- For injection/compression molding operations to reduce HAP emissions by instituting operational practices where only one charge per machine is uncovered, unwrapped, or exposed per mold cycle.
- For sheet molding compound operations at existing sources below the threshold, and new sources with HAP emission less than 100 tpy, to reduce emissions by using a nylon film, or film of equal or lower permeability to styrene, to enclose SMC operations.
- For resin mixing and bulk molding compound operations at existing sources below the threshold, and new sources with HAP emissions less than 100 tpy, to limit emissions by covering mixers such that there are no visible gaps.
- In general, other new and existing sources must reduce emissions by 95 percent.

Additional work practice and operational standards are proposed for all facilities. EPA is proposing that subject facilities keep all organic HAP-containing storage vessels covered, except during the addition or removal of materials. Furthermore, all affected sources will be required to use cleaners that contain no HAP.

As indicated above, the proposed rule requires that certain new and existing sources control HAP emissions by 95 percent. In order to meet this requirement, facilities will likely have to capture 100 percent of their emissions from the affected processes and route these emissions to an add-on control device. Additionally, the add-on control device must meet all requirements contained in 40 CFR part 63, subpart SS.

Compliance Period

EPA is proposing that all existing sources comply within 3 years of publication of the promulgated NESHAP in the Federal Register. New affected sources that startup before the promulgated NESHAP are published must comply no later than the effective date of the NESHAP, which will be the same as the publication date. New affected sources that startup after the promulgated NESHAP are published must comply upon startup.

Under the proposal, new and existing facilities will have 3 years to comply from the time their HAP emissions reach or exceed the applicability thresholds requiring the installation of add-on controls, if the HAP emissions increases occur after their initial compliance date.

Monitoring, Reporting, and Recordkeeping

These proposed NESHAP contain monitoring, reporting, and recordkeeping requirements. However, fulfillment of these requirements, depends on how the facility chooses to comply with the proposed NESHAP.

The facility must submit an initial notification stating that they are subject to the proposed NESHAP. After the compliance date, a notification of compliance status must be submitted, and semiannual reports are required thereafter. If the facility uses an add-on device to reduce emissions and becomes out of compliance, quarterly reports of compliance status are required, until EPA approves a request to return to semiannual reporting. Preconstruction notification is required of new sources.

Comments

EPA is soliciting comments on the proposed rule, especially in the following areas:

- Data on the technical feasibility of permanent total enclosures (PTE) for capturing 100 percent emissions.
- Data on a facility's ability to maintain and operate add-on controls, especially in the areas of cost and design from facilities in the industry that have successfully applied add-on controls.
- Data on control device inlet air flows and HAP concentrations combined with worker exposure monitoring data would be useful.
- Data on typical operation hours in this industry, particularly in relation to the size of the facilities and their operations, since operating hours affect cost effectiveness and the number of start-ups and shutdowns.
- Information on the adequacy or necessity of the monitoring, recordkeeping, and reporting requirements in the proposed rule.

Comments can be submitted by U.S. Postal Service or by electronic mail on or before 1 October 2001.

Overview of Aeronautical Systems Center's Pollution Prevention Solutions Database

Aeronautical Systems Center (ASC) is the procurement center for Air Force (AF) major weapon systems. The Center's System Program Offices (SPOs) are responsible for developing, building fielding and maintaining AF major weapon systems. The AF "Single Manager" concept strives to centralize the management of major systems from cradle to grave. Clearly, with responsibility for design of new systems and maintenance and upgrade of legacy systems, the SPOs must strive to eliminate polluting chemicals and processes from these systems.

The Center's Environmental Safety and Health Division (ASC/ENV) is part of the Engineering Directorate and has responsibilities that encompass acquisition pollution prevention (P2) as well as management of Government Owned Contractor Operated (GOCO) manufacturing plants; plant pollution compliance, restoration, and plant divestiture. The Pollution Prevention Office, ASC/ENVV, is responsible for Environmental, Safety, and Health (ESH) training and for championing P2 in the Acquisition Systems Engineering community. The P2 Office also provides the Single Manager with the expertise to identify and comply with the multitude of environmental regulations and laws, and develop, obtain funding, and manage pollution prevention projects aimed at providing alternatives to polluting processes and chemicals. In addition to the SPOs, ASC/ENVV work closely with the Air Force Research Laboratory (AFRL) and AF Materiel Command (AFMC) Logistic Support Centers.

Problem - P2 projects that seek alternatives for multiple systems or processes are often funded by the Headquarters Air Force Materiel Command, Environmental Quality Branch (HQ-AFMC/CEVQ), Pollution Prevention Integrated Product Team (P2-IPT) or with funds passed through the IPT to ENVV. However, the Program Offices often use weapon system funds for projects developed for a single weapon system or which will affect cost, schedule, or mission effectiveness of a system while waiting for other funding. Reporting of the status/results of these projects is not required outside the procurement reporting chain. Thus significant numbers of projects lose visibility to the rest of the AF and Department of Defense (DoD). Regular cross feed meetings with SPO pollution prevention personnel have been used to report findings with limited success across ASC.

Solution - ASC/ENVV has developed a Pollution Prevention Project database called Solutions. Developed in-house as a simple Microsoft Access database, it includes 17 data fields. As shown in Figure 7 on the next page, the data fields were developed in part to mirror AFMC HQ's "EQ" database.

Expanding the Solution - A problem still existed in providing visibility of ASC Solutions to the AF and DoD. We have addressed this problem by porting the database to the World Wide Web (see Figure 8 on the next page). Using VB Script, the data was ported to and is now available through ASC's Engineering Division's .mil web site. ASC/EN's site is currently available only to .mil users. The data will soon be copied to ENV's Public web site to increase visibility.

The ASC P2 office is currently merging analysis of future regulatory changes and future needs with the database to develop a roadmap to guide future P2 project proposals.

Maintenance - The most excruciating problem faced by a database manager is keeping the data current. Potential customers will not trust the data if they find errors or outdated data. For this reason, we have included the ability for project managers to update project data "on line" through the web site. Data integrity is protected with a password and ID system. Historical data is important and once a project is completed will be static; however, ongoing projects will be updated as results occur. Figure 9 (on page 16) shows a typical project in the Database that will require routine maintenance.

Future Needs - From the original SPO data, we have expanded to AFRL and GOCO projects. At this time, we are developing the links needed to include projects that have been accomplished by AFMC Logistic Support Centers. In addition, weapon system contractors have begun to provide data on projects funded by these contractors. For the

Element Name	Description	Data Type
HAZMAT	Name of the hazardous material to be eliminated	Pull Down
Category	Identifies the programs that target the HAZMAT for reduction	Pull Down
Alternative	Alternative material/process that has been substituted for the hazardous chemical	Pull Down
System	Identifies the ASC Weapon System for this project	Pull Down
Subsystem	Specific aircraft component discussed	Pull Down
Mgt POC	System Program Office's Environmental Co-Locate	Pull Down
Mgt Phone	System Program Office's Environmental Co-Locates Phone Number	Pull Down
Tech POC	Technical POC - Identifies the person most familiar with the technical component of this project - may be a contractor	Pull Down
Tech Phone	Technical POC's phone number	Pull Down
Old Process	Description of the current process	Memo
New Process	Description of the alternative process	Memo
Title	Project title	Text
ProjNumber	Project number (tied to the funding process or contractual obligation)	Text
Status	Project status	Table
Start Date	Date when the project began	Date
End Date	Date when the project was/will be completed	Date
Last Revised Date	Date this entry was last revised	Date
Compliance Driver	Identifies the regulation driving the need for a replacement process or material**	Table
Material or Substrate	Type of material/substrate on the weapon system this project impacts**	Text
HMRPP Category	Hazardous Material Reduction Prioritization Process (HMRPP) Category - see HQ AFMC/DR's web site	Pull Down
Processes	HMRPP Subprocess	Pull Down
TechNeedID	Technology Need Identification number, as assigned by the ESOH TPIPT (http://www.hscxre.brooks.af.mil)	Pull Down
NeedLevel	Ranking given to the Tech Need ID by the ESOH TPIPT	Pull Down

Figure 7. Pollution Prevention Project Database Data Fields

most part this contractor information is currently not in a readily available forum and should be a tremendous addition to the Solutions Database.

The ASC P2 office has responsibility for publication of the AFMC P2 newsletter The Monitor also under contract to SAIC. This publication has been used for several years as an additional avenue to publicize success stories, and is available on our public web site. We are working to synergize this activity with the Solutions Database and provide links from projects to consolidated success stories; reporting on multiple related projects.

Figure 8. Solutions Database Ported to the Web

Customer Feedback - Customer feedback has exposed the need to improve search routines and to include on-line search hints to assist people in finding the data they need. The initial version of the web system required the researcher to select search words from pull-down menus. This was done to avoid typing complex chemical names that might have more than one form, and to expose categories available to the researcher before initiating a search. The intention was to save time and reduce errors. Feedback however, indicates we need to provide some measure of free-form word search capability. Occasionally a researcher knows a few key words concerning a project they want to review but not sufficient specifics to predict how the project might have been input. Additionally it appears

Figure 9. Overview of a Typcial Project in the Solutions Database

some broader categories need to be developed in order to give the searcher a better opportunity to "drill down" to the specifics desired.

Conclusion - Initial feedback has assured us this information is valuable and useful to our customers. As the basis of the data broadens and we develop improved search capabilities, we believe this will only improve. Our objective to serve the Air Force and DoD Acquisition Community with a useful tool to reduce duplication of effort and to use for planning purposes appears to be in sight. Linkage to the Environmental Development Planning, formally ESOH TPIPT needs list assists in closing the loop on the AF Pollution Prevention process.

For further information about ASC/ENVV's SOLUTIONS DATABASE, please visit the web site at https://www.en.wpafb.af.mil, select services select solutions or contact Mr. Frank Brown at DSN 785-3059 ext. 331.

Solutions Database - Projects to Eliminate Chromium from Air Force Weapon Systems

Category	Weapon System/POC	Project Title	Status
Adhesive & Sealants	C-17 Capt Almosara, ASC/YCES DSN 986-9311	Evaluate Low-Chrome Sealant for Anodize	Ongoing
		Evaluation/Implementation ODC Free Silicone Adhesion Promoter	Completed
		Evaluate Non-Chromate Curing Sealant	Completed
		Evaluate Non-Chromated Corrosion Inhibiting Faying Surface Sealant	Completed
		Evaluation/Implementation Non-Chromated Corrosion Inhibiting Fillet Sealant	Completed
	F-16 Mary Wyderski, ASC/YPVE DSN 986-6178	Non-Chromated Sealants	Completed
	Air Force Plant 4 Ted Grady, ASC/ENVC DSN 785-3059	Replacement of AFM 3055 Chromated Sealants	Completed
	AFRL/MLSA Al Fletcher DSN 785-7481	Replacement of Non-Toxic Sealant & Primers	Ongoing
Conversion Coating	AFRL/MLQL Tom Naguy DSN 986-5693	Non-Chromate Conversion Coating for Large Application Areas (DO34)	Completed
	AFRL/MLBT Mike Donley DSN 785-6485	Environmentally Compliant Sol-Gel Surface Treatments	Ongoing
		Sol Gel Coating Formulation (DO31)	Completed
	Raytheon Doug Oliver 316-676-8626	Qualification of Alodine 600 to Replace Alodine 1200	Completed
	C-17 Capt Almosara, ASC/YCES DSN 986-9311	Evaluate Non-Chrome Conversion Coating	Completed
		Evaluate Non-Chromated Tie Coat for Leading Edge Erosion Protective Tape	Completed
	F-16 Mary Wyderski, ASC/YPVE DSN 986-6178	Sulfuric Acid Anodizing	Completed
		Non-Chromated Conversion Coatings	Ongoing
	Air Force Plant 4 Ted Grady, ASC/ENVC DSN 785-3059	Elimination of Spray Chem Film	Completed

Examples of Projects in Solutions Database by Category (Continued)

Category	Weapon System/POC	Project Title	Status
Conversion Coating	CTIO CTIO/SMA DSN 785-4169 ext. 3014	Chrome Conversion Coatings Replacement	Completed
	AFRL/MLSA Jim Mazza DSN 785-7778	Sol Gel Techniques for Low VOC, Non-Chromated Adhesive and Sealant Application	Ongoing
	AFRL/MLQE J. Hurley DSN 523-6243	Non-Chromate Conversion Coating for IVD Aluminum	Completed
	JG-PP Bob Hill 321-867-6176	Chrome Free Conversion Coatings	Completed
Painting & Depainting	PEWG Frank Ivancic, ASC/LPA/SM DSN 785-0444 ext. 3185	Eliminate ZnCr3 in Engine Wash	Completed
	JG-PP David James 703-767-2421	Chromate-Free Primers and Sealants	Completed
		Non-Chromate Primers for Aircraft Exteriors	Ongoing
	C-17 Capt Almosara, ASC/YCES DSN 986-9311	Evaluate Non-Chromated Tie Coat for Leading Edge Erosion Protective Tape	Completed
		JG-PP Non-Chromated Primer Qualification Program	Completed
	F-22 Jared Scot, ASC/YFAPC DSN 785-1422 ext. 2390	Joint Non-Chromated Primer	Ongoing
Painting & Depainting	CTIO CTIO/SMA DSN 785-4169 ext. 3014	Non-Chromate Primer Tie Coat	Completed
	AFRL/MLBT Mike Donley DSN 785-6485	Transition From Chromates to Chromate Free Corrosion Protection	Ongoing
	F-16 Mary Wyderski, ASC/YPVE DSN 986-6178	Primer for FMS-3049	Ongoing
	JSF (JSF) DSN 785-9697 ext. 4157	Electro-coat	Ongoing
	Raytheon Doug Oliver 316-676-8626	Replacement of Chrome in Stratium Chromate of Paint Primers (ESOH Need 1931)	Ongoing
Plating & Metal Finishing	PEWG Frank Ivancic, ASC/LPA/SM DSN 785-0444 ext. 3185	Closed Loop Electroless Nickel	Ongoing
		Overhaul of Gas Turbine Engine (GTE) Parts	Ongoing
	JSF (JSF) DSN 785-9697 ext. 4157	Hard Chrome Alternatives	Ongoing
		Thermal Coatings	Ongoing
	JG-PP AFMC/LGP-EV DSN 785-7505	Chromium Electroplating Alternatives for Propeller Hubs	Ongoing
		Chromium Electroplating Alternatives for Landing Gear	Ongoing
		Chromium Free Primer for Inserts and Fasteners	Ongoing
	AFRL/MLPJ John Eric DSN 785-2334 ext. 3165	Laser-based Techniques for Replacing Chrome Plating	Completed
	ENVV Chuck Valley, ASC/ENVV DSN 785-3054	Environmentally Compliant Parts Process Sequence (ECPPS)	Completed
	AFRL/MLQL Tom Naguy DSN 986-5693	Non Lone of Sight (NLOS) Alternatives for Chrome Plating	Ongoing
		HVOF Coating for A/C Components (DO49)	Ongoing
		Characterize Environmentally Acceptable Thin Film Catg. Materials to Replace Chrome (DO15)	Completed

Evaluation of Mobile Integrated Aircraft Deicing System

Aircraft deicing systems represent a significant financial and compliance burden to DoD and commercial air installations. Aircraft deicing fluids (ADFs), typically glycols, are potent aquatic toxins, exerting very high chemical and biochemical oxygen demand (COD, BOD) on receiving waters. In addition, ADFs have significant physical containment and regulatory reporting requirements, being covered under the National Pollutant Discharge Elimination System (NPDES) and Clean Water Act (CWA). Even the latest non-glycol based ADFs require containment and disposal operations and their inherent costs. One example of a large containment system installed at a commercial airport cost $80 million alone! The Government Accounting Office (GAO) reports that the control of spent deicing fluids is second only to aircraft noise abatement among environmental concerns at airports today. The EPA has reported that delays, noise and deicing are three of the top economic drivers at airports. In addition, the Army cannot use glycol based ADF's to deice their rotary aircraft because of dilution of lubricants in the rotor hubs which could lead to catastrophic failures.

Air Force Materiel Command (AFMC) has identified a mobile integrated infrared deicing/anti-icing system technology as the most promising alternative to fluid based deicing. This system combines 3 non-fluid based technologies together to deice aircraft. Figure 10 describes the 3 non-fluid components of a Mobile Integrated Infrared Deicing/Anti-icing System. Anti-icing fluids will still be required to satisfy appropriate holdover times and will be part of the system. Their use will be small compared to present ADFs and is assumed to not require permitting. Over time, new non-glycol based anti-icing fluids will be developed and integrated into the system which will result in the total elimination of glycol in deicing operations. The three technologies to be integrated are forced air, infrared heaters and ice detection. Anti-icing will be a standard system at this time.

Infrared Heating	Infrared heating technology includes mobile, compressed natural gas (CNG) or propane powered flameless heaters which are used on wings and airplane bodies to melt accumulated ice and snow.
Forced Air	A forced air system uses high velocity air to physically clean surfaces.
Ice Imaging System	Ice imaging systems help technicians identify where ice is present on aircraft. Ice imagers are typically portable camera-like units that use the depolarization of scattered laser light and spectral analysis of ambient light to detect ice formation.

Figure 10. Integrated Deicing/Anti-icing System

AFMC will conduct a detailed study of a mobile integrated system in an attempt to reduce or eliminate the need for fluid-based deicers and their associated tracking, permitting, and contaminant costs. The research, to be conducted at the Air Force's McKinley Climatic Chamber at Eglin AFB, FL, will take place over 4 days in March of 2002. This climatic chamber is the largest of its type in the world, capable of testing aircraft as large as a C-5 in a number of various conditions. The present test program will determine critical performance factors that will be integrated into the unit's final design. Present unknowns are rate of deicing, possible refreeze in quiet areas of the aircraft and safe operations of the infrared heating wand, which is massive in size.

An infrared deicing system such as the proposed truck mounted, mobile, flameless Ice-Cat™, with aircraft surface temperature feedback for control of the heating, was demonstrated at Kansas City International Airport, Montreal

Continued on Page 23

Air National Guard Compliance Through Pollution Prevention Web Site

The Air National Guard (ANG) has had tremendous success in agency-wide pollution prevention. Part of this ongoing P2 effort is outlined in Draft Air Force Instruction (AFI) 32-7080, Compliance through Pollution Prevention (CTP2). In this process, pollution sources (compliance sites) are removed or eliminated in an effort to reduce the total compliance burden of a facility. There are three phases in the CTP2 process; Phase 1, Compliance Site Inventory, Phase II, Compliance Site Prioritization, and Phase III, Identification of P2 Solutions.

ANG is currently leading the Air Force into Phase III of this process. To help better accomplish this, ANG has

developed a Compliance Through Pollution Prevention Mission Support Portal (CTP2 MSP), a web-based database module that allows environmental personnel easy access to P2 data included in the ANG Compliance Assurance Pollution Prevention Management Action Plans (MAPs). Through the MSP, the Air National Guard Readiness Center (ANGRC), ANG bases, and ANG contractors are able to quickly access P2 solutions already in place at other ANG bases or post information of their own.

Using the CTP2 MSP, Environmental Managers may search for P2 solutions by name or by base. Users can also get listings of all compliance sites at a particular base and print out query-based reports grouping P2 solutions and compliance sites by type and priority. The system also tracks compliance costs by site.

The benefits of the CTP2 MSP are numerous, but include:

- The MSP allows the CTP2 program to be virtually integrated, in real time, across organizational, financial, and state boundaries;
- ANG bases are able to access P2 solutions from other bases with same processes;
- Many users may access the web-based data at the same time;
- Information is rolled up to executive summary level information for full comprehension.

For further information, contact Munther Jabbur, Air National Guard (ANG)/Civil Engineering Environmental Quality (CEVQ) at 301-836-8293 or e-mail, munther.jabbur@ang.af.mil, or contact Doug Anderson at 301-836-8135 or e-mail doug.anderson@ang.af.mil.

Source: 6th Annual Joint Services Pollution Prevention and Hazardous Waste Management Conference and Exhibition: Conference Proceedings. 2001.

Report on Automation of Aerospace Recordkeeping at Tinker Air Force Base, OK

The aerospace manufacturing and reworking industry is subject to a number of regulatory standards, including the Clean Air Act (CAA) and the national emission standards for hazardous air pollutants (NESHAP). These standards, especially NESHAP, require significant monitoring and recordkeeping of pollution producing activities at facilities. Specifically, paint shops are required to document the amount of coating applied to planes and to monitor the pressure drop across particulate filters. Most facilities fulfill these recordkeeping requirements through the use of logbooks and handwritten entries that are sometimes transferred to electronic files. There are many drawbacks to this method of recordkeeping, including transcription errors and inaccurate logbooks.

Tinker Air Force Base is the home of Oklahoma City Air Logistics Center (OC-ALC). The installation, among other things, is responsible for the maintenance of a number of aircraft systems including the B-52, B-1, KC-135 and other aircraft. There are two paint booths on-site that fall under NESHAP reporting requirements. Current NESHAP compliance is accomplished by manual transcription of the readings of various gauges associated with the paint booth onto logsheets that are eventually filed away. CH2M HILL was charged with developing an effective automated data logging system that could increase the efficiency of the recordkeeping efforts while decreasing the risks of non-compliance.

The contractor tested approximately 30 automated data logging systems to determine which make and model would best meet a number of criteria. Among these, some of the most important system requirements included:

- The ability to monitor up to 6 different data sources from the 2 paint booths at once (2 differential pressure sensors, 2 system on/off sensors, and 2 filter change sensors);
- Easy programmability to ensure accurate range of functions;
- Sufficient control options (through keyboard/screen interface);
- Compatibility with Tinker AFB network

Each datalogger was tested and a results matrix was developed which allowed Tinker AFB and CH2M HILL to compare the performance of each datalogger. Typically, data loggers were rejected due to a lack of control options. The dataloggers included in Figure 11 on the next page represent the 5 best suited for use in the Tinker AFB system.

Based on these results, the Campbell-Scientific model CR23X was selected for use at Tinker AFB. It was installed with the guidance of CH2M HILL and connected to the Tinker AFB LAN by the 72nd Communications Squadron. Data is transmitted over this LAN and can be accessed though a Windows 2000 machine and imported into Microsoft Access via an application developed by CH2M HILL expressly for that purpose. Customizable reports can be easily generated and real-time monitoring for both paint booths is possible.

Manufacturer	Campbell Scientific	Campbell Scientific	2	3	4
Model	**CR23X**	**CR10X**	**A**	**B**	**C**
Differential Inputs	12	6	14	10	16
Control/Digital Ports	8	8	10	2	4
Excitation Channels	4	3	1	None	4
Is Unit Programmable?	Yes	Yes	Yes	Yes	Yes
Keyboard?	Yes	No	No	Yes	No
Message Display Capable?	Yes	No	No	No	No
Optically isolated?	Yes	No	No	Yes	No
Communications Port	RS232	Campbell 9 pin port	RS232	RS232	RS232
Volatile or Non-Volatile Memory	Nonvolatile	Nonvolatile	Nonvolatile	Nonvolatile	Nonvolatile
Compatible with Network?	Yes	Yes	Yes	No	No (Manual Download)
Averaging Capabilities	Yes	Yes	Yes	Yes	Yes
Upgradable?	Yes	Yes	Yes	Yes	Yes

Figure 11. Market Survey of Available Dataloggers (at time of survey)

Overall, automated data logging has been shown to be an effective and accurate method to maintain Aerospace NESHAP compliance.

For more information, contact Mr. Bede Ley at Tinker Air Force Base at 405-734-4556, or e-mail, bede.ley@tinker.af.mil.

Source: 6th Annual Joint Services Pollution Prevention and Hazardous Waste Management Conference and Exhibition: Conference Proceedings. 2001.

VOC Destruction Using Electron Beams

Introduction

Volatile Organic Compounds (VOCs) are common contaminants of drinking water, groundwater, and other industrial wastes and must often be removed. There are several methods available, each with advantages and disadvantages, to eliminate or reduce VOCs in liquid streams. Many of the technologies remove and concentrate the VOCs for collection or destruction while others destroy the entire contaminated liquid stream. Figure 12 lists some of the common methods used to remove or destroy VOCs in liquid streams and their disadvantages.

Removal/Destruction Method	Disadvantages
Thermal Oxidation	Relatively expensive, often creates undesirable by-products (e.g., dioxins)
Biological Treatment	Slow, susceptible to poisoning
Chemical oxidation (using ozone or hydrogen peroxide)	Requires long reaction times, use of catalysts
Radiant energy treatment (using gamma or X-rays)	Radiation that requires shielding
Ultraviolet (UV) oxidation/outdated e-beams	Only treat water with low levels of organics

Figure 12. Disadvantages of Current Methods Used to Destroy VOCs

Electron Beam Technology

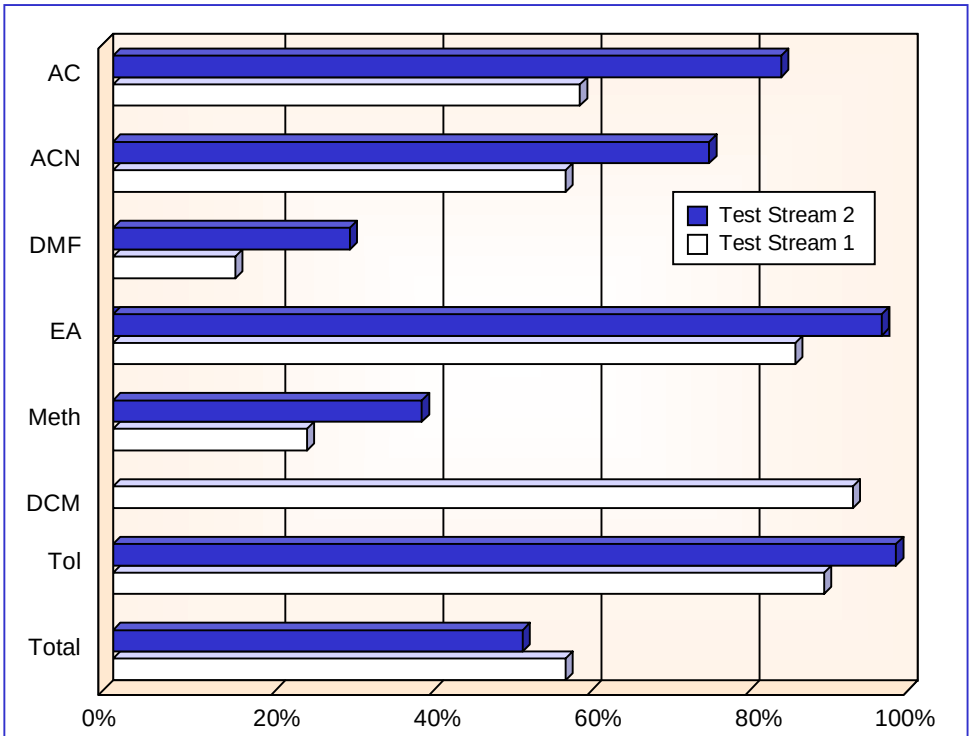
Recently, a new technology for removing and destroying VOCs in liquid streams has been developed and is being evaluated at the University of Tennessee Space Institute near Tullahoma, Tennessee. This new technology (U.S. Patent 5,807,491) uses a reaction chamber to volatilize VOCs in aqueous waste streams after which they are converted into carbon dioxide and water by being irradiated with high-energy electrons. Unlike traditional electron-beam (e-beam) systems, which only applied to liquid phase organics, this new system was designed to treat organically contaminated liquid wastes by combining the benefits of liquid-phase treatment with that of gas-phase treat-

ment. This was made possible through the combined effort of the special reaction chamber, advanced e-beam equipment, and use of a downstream scrubber and carbon adsorber to treat other liquid contaminants as well as gases, such as hydrochloric acid. The equipment is currently installed in a truck trailer to allow it to be transported to contaminated sites or waste streams.

An important factor in the effective reaction of organics in air is ionization potential. Ionization potential is the minimum energy required to remove an electron from an isolated molecular entity in the gaseous phase. In order for a VOC to be destroyed, it must have an ionization potential that is less than that of its carrier gas, which is usually air.

Initial Test Program

An initial test program was conducted on two mixtures of VOCs in water. Approximately 2.5 liters of VOC waste containing liquid was added to the reactor. Samples were taken initially and at accumulated doses of 5, 10, 25, 50, 100, and 125 kGy (energy dose defined by total amount of energy absorbed divided by the mass being treated). Figure 13 reports the results of the initial test program.



Where: AC - acetone, CAN - acetonitrile, DMF - dimethylformamide, EA - ethyl acetate, Meth - methanol, DCM - dichloromethane (methylene chloride), and Tol - toluene

The two waste streams were characterized by a contaminant concentration ranging from 81 ppm to 35,220 ppm. The lower destruction efficiencies in Figure 13 appear to be related to both ionization potential and the lack of optimization of the process. Inspection of the data also indicated that the use of ozone as part of the carrier gas and the addition of a small amount of hydrogen peroxide could aid in increasing the speed of the reduction process. In a fully operating proprietary reaction chamber, though, oxidants such as ozone and hydrogen peroxide should not be needed except for recalcitrant wastes.

Prototype

A prototype e-beam plant, including an e-beam reactor, acid gas scrubber, and final carbon adsorber, has been proposed with the capability to process 100,000,000 cubic feet of air per year contaminated with approximately 500 ppmv trichloroethylene. Using the typical chemical engineering cost estimating technique, a total capacity requirement of $874,244 was estimated. After this figure is annualized and added to estimated operating costs, the annualized cost is estimated to be $757,285 or about $7.57 per 1,000 cubic feet of gas treated.

For more information, please contact Mr. David R. Patrick, P.E., Sciences International Inc., Alexandria, VA, 703-684-0123, dpatrick@sciences.com.

Source: Proceedings of the Air & Waste Management Association's 94th Annual Conference & Exhibition, Orlando, Florida, June 24-28, 2001.

Biofiltration of VOC's from Paint Manufacturing

Hazardous air pollutant (HAP) standards for the paint manufacturing industry are being established with more realistically achievable emission removal levels. Soaring energy costs makes biofiltration a viable solution to address volatile organic compound (VOC) and HAP emissions.

Bio-Reaction Industries, LLC. Bio-Reaction Industries (BRI) has teamed with Forrest Paint to install the first engineered biofilter for the emission stream of a paint manufacturing facility. In December 2000, installation and start-up of the prototype biofilter began.

Biofilters are made up of single or multiple beds of substrate. Bacteria and other organisms use this substrate to attach and grow. The organisms then feed on the VOCs and HAPs in the air emissions from the manufacturing/ mixing processes. Biofilters are energy efficient to operate and don't produce additional greenhouse gases.

Compound	%
Toluene*	25
Methyl Ethyl Ketone*	23
m-and p-Xylene*	20
Ethyl Benzene*	6
o-Xylene*	5
l-Butanol	3
Acetone	2.5
Ethane	2.2
Methane	2
Ethanol	1
Isobutyl Alcohol	1
Butane	1

** Hazardous Air Pollutants (HAPs)*

Figure 14. Representation of VOC Analysis from Paint Preparation Emissions

The Forrest Paint facility contains several mixing vats used for preparing different types of paints for the industrial market. Many of the products produced at Forrest Paint are high temperature enamel paints that contain high percentages of VOCs. At each mixing vat, moveable fume collection hoods are present to collect emissions as mixing takes place. The paint preparation procedure releases mainly aliphatic hydrocarbons. A typical analysis of VOCs and HAPs present in the emission stream is presented in Figure 14.

Installation of the initial, prototype biofilter was carried out over several days in December 2000. Startup consisted of the introducing process air from the fume hoods and steam in an incremental manor. This process took place over a period of four weeks. The temperature was increased to the operating range of 80 to 100F within the first day. The prototype biofilter was operated at as close to 85F and 98% relative humidity as possible.

The unit is computerized to minimize operator control of the system. It is designed so that the operator can override the controls whenever needed. Temperature alarms are installed to alert personnel if a malfunction occurs. Operation of the biofilter should be checked twice daily in order to insure best possible operation. Forrest Paint personnel performed a minimum of weekly sampling of inlet and outlet gas streams with a hand-held photo ionization detector (PID), and additional field sampling was conducted by BRI using a flame-ionization detector (FID). Additional bag samples were collected and analyzed by a local laboratory to provide assurance of VOCs and HAP removal by the biofilter.

Figure 15. The New BRI-Forrest Paint biofilter

The prototype biofilter at Forrest Paint operated at 60% or better destruction efficiency (Dre). This lower Dre (than the expected 85%) was due to inadequate size of the prototype biofilter that was based on poor initial emissions data. BRI developed and installed a new, larger unit at Forrest Paint based on the operational data collected from the prototype biofilter. One week after start-up on September 17, 2001, testing revealed a Dre greater than 80%. The new BRI-Forrest Paint biofilter is shown in Figure 15.

For further information, please contact, James Boswell, BRI at 1-888-508-2808 or e-mail jboswell@bioreaction.com.

Source: Proceedings of the Air & Waste Management Association's 94th Annual Conference & Exhibition, Orlando, Florida, June 24-28, 2001.

Evaluation of Mobile Integrated Aircraft Deicing System (Continued from Page 18)

(See Dorval Airport, and on Air National Guard aircraft in Pittsburgh, PA. Other infrared systems are in use, but presently do not have surface temperature control feedback and by design are fixed structures. In these systems possibility of heat damage to composite materials and uneven melting of ice and snow may result. Anti-icing is a separate operation. Forced air equipment is already used with some traditional mobile glycol-based fluid deicing operations to help remove accumulated snow from aircraft prior to application of deicing fluids and has been a great advancement in the reduction of energy required to remove loose contaminants. Since forced air cannot remove the frost, ice or frozen snow, there is a requirement for additional ADFs or infrared heat to complete the deicing operation.

If the tests chamber results are successful, Phase II of the program will involve field testing the integrated infrared mobile unit.

The successful testing and implementation would have numerous environmental, economic, and operational benefits for the U.S. Military. Most importantly, glycol use would be vastly reduced or eliminated, resulting in significant water quality improvements to runoff receiving waters. In addition, the potential for enforcement actions from violations of CWA or NPDES regulations would be greatly reduced, along with the potential for adverse training impacts and negative publicity.

For further information, please contact, Mary Wyderski, AFMC at (937) 656-6178 or e-mail, mary.wyderski@wpafb.af.mil.

Useful Web Sites

Name	Web site
Joint Group on Pollution Prevention (JG-PP)	www.jgpp.com
Propulsions Environmental Working Group (PEWG)	www.pewg.com
Defense Environmental Network Information Exchange (DENIX)	www.denix.osd.mil
Air Force Center for Environmental Excellence (AFCEE)	www.afcee.af.mil
National Defense Center for Environmental Excellence (NDCEE)	www.ndcee.com
AF Environmental, Safety, and Occupational Health Technical Planning Integrated Product Team (ESOH TPIPT)	Xre22.brooks.af.mil/hscxre/xrehome.htm
Navair, Environmental Site	navair.alc.daps.mil
AF Corrosion Office	www.cpo.com
Environmental Protection Agency	www.epa.gov
Aerospace Industry Association (AIA)	www.aia-aerospace.org
AF Institute of Environmental Risk Analysis (AF IERA)	sg-www.satx.disa.mil/iera
Air Force Research Laboratory, Materials, & Directorate	www.ml.afrl.af.mil
Strategic Environmental Research & Development Program (SERDP)	www.serdp.com
Environmental Security Technology Certification Program (ESTCP)	www.estcp.com
Hard Chrome Alternative Team (HCAT)	www.hcat.com
National Metal Finishing Resource Center, Hard Chrome Forum	www.nmfrc.com